# VTM Test Equipment

Vehicle-Tank Meters

NIST Short Course

# Objectives

- identify and describe the use of test equipment used in VTM LMD testing
- describe the set-up, operation, and maintenance of VTM field standard prover
- describe the steps in drawing an official test draft

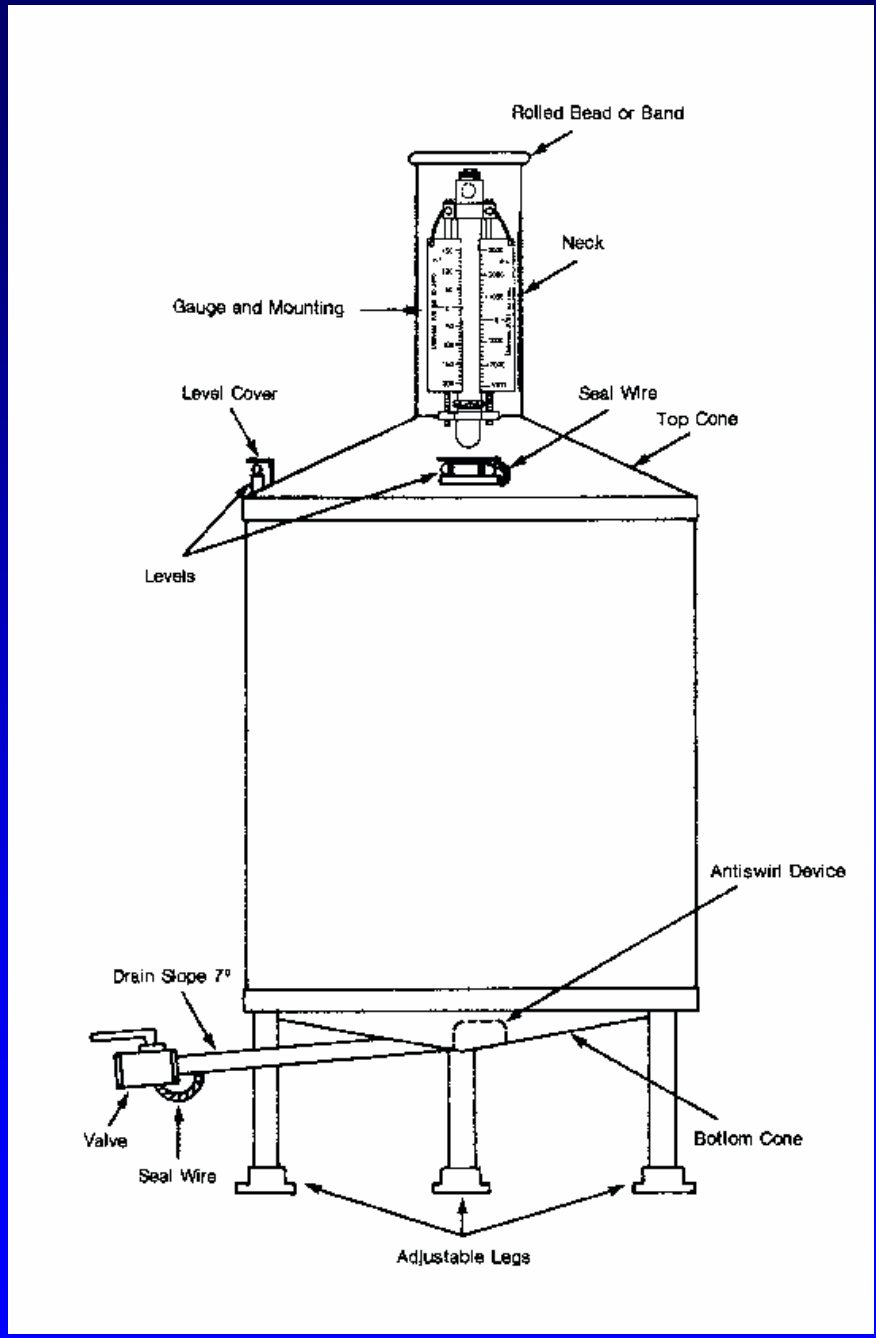
# Test Equipment

- safety gear
  - fire extinguisher
  - prover grounding cable
  - first aid kit
  - special gear such as goggles, gloves, etc.
- stop watch
- 5-gallon metal bucket
- NIST Handbook 44 & other applicable codes
- EPOs, worksheets, checklists, report forms
- security seals, inspection stickers/tags
- field standard prover appropriate for application

# Field Standard Prover

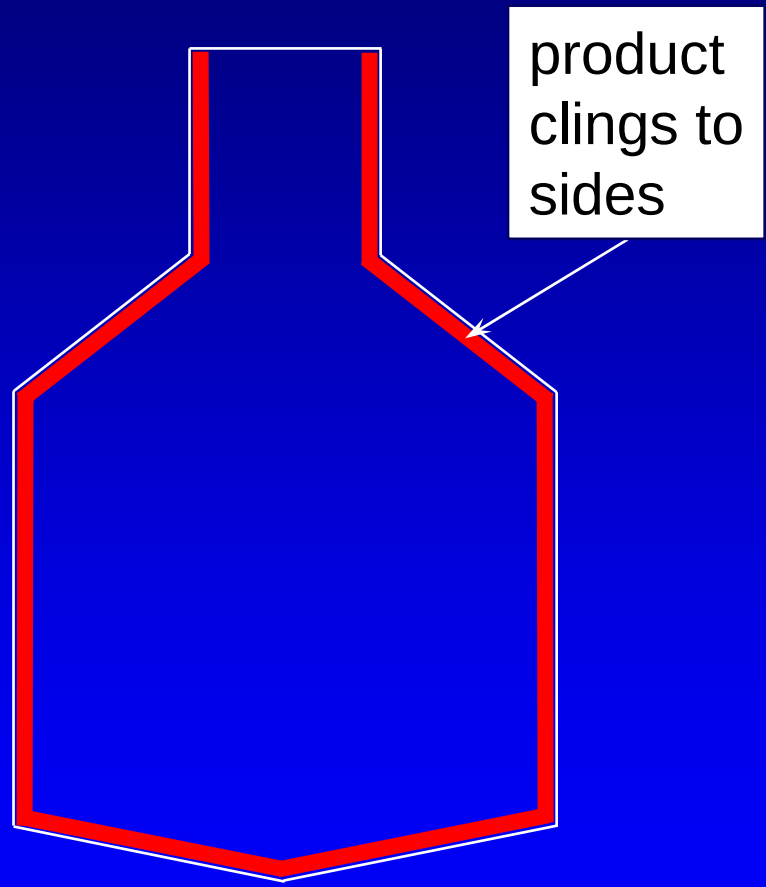
- design to approximate normal use
- specifications in NIST Handbook 105-3
- typically low carbon or stainless steel
  - interior coated to resist corrosion
- capacity to accommodate quantity delivered by system in one minute at maximum discharge
  - not less than 50 gallons

# Figure 4-1: VTM Field Standard Prover



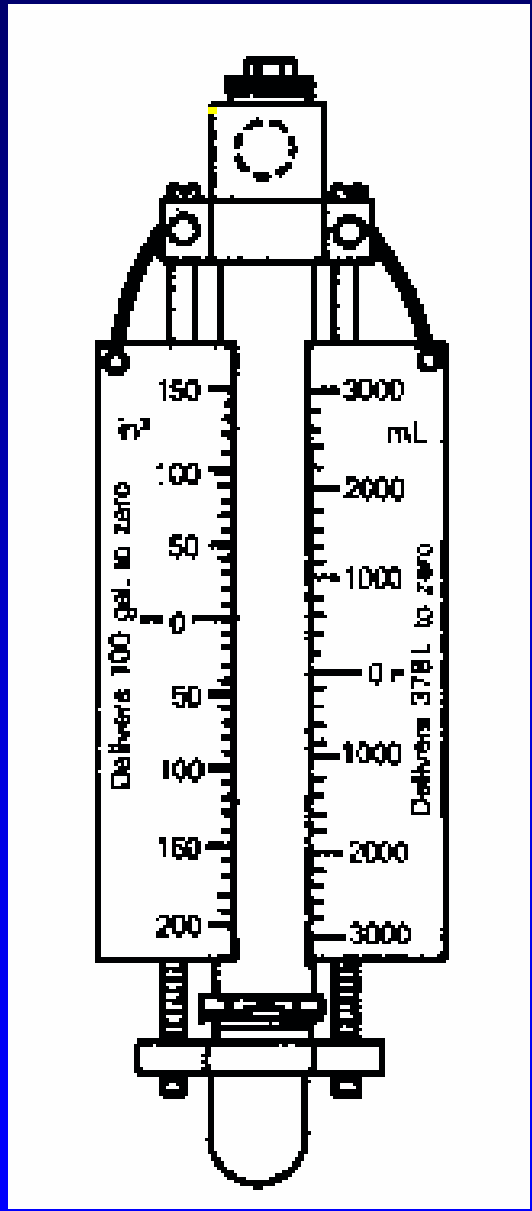
# Field Standard Prover

- calibrated “to deliver” specific quantity
  - contains slightly more than its nominal capacity
  - even after draining, a film will cling to sides
  - requires specified drain time between drafts
  - drain time marked on prover at calibration



# Figure 4-2: Gauge Plate

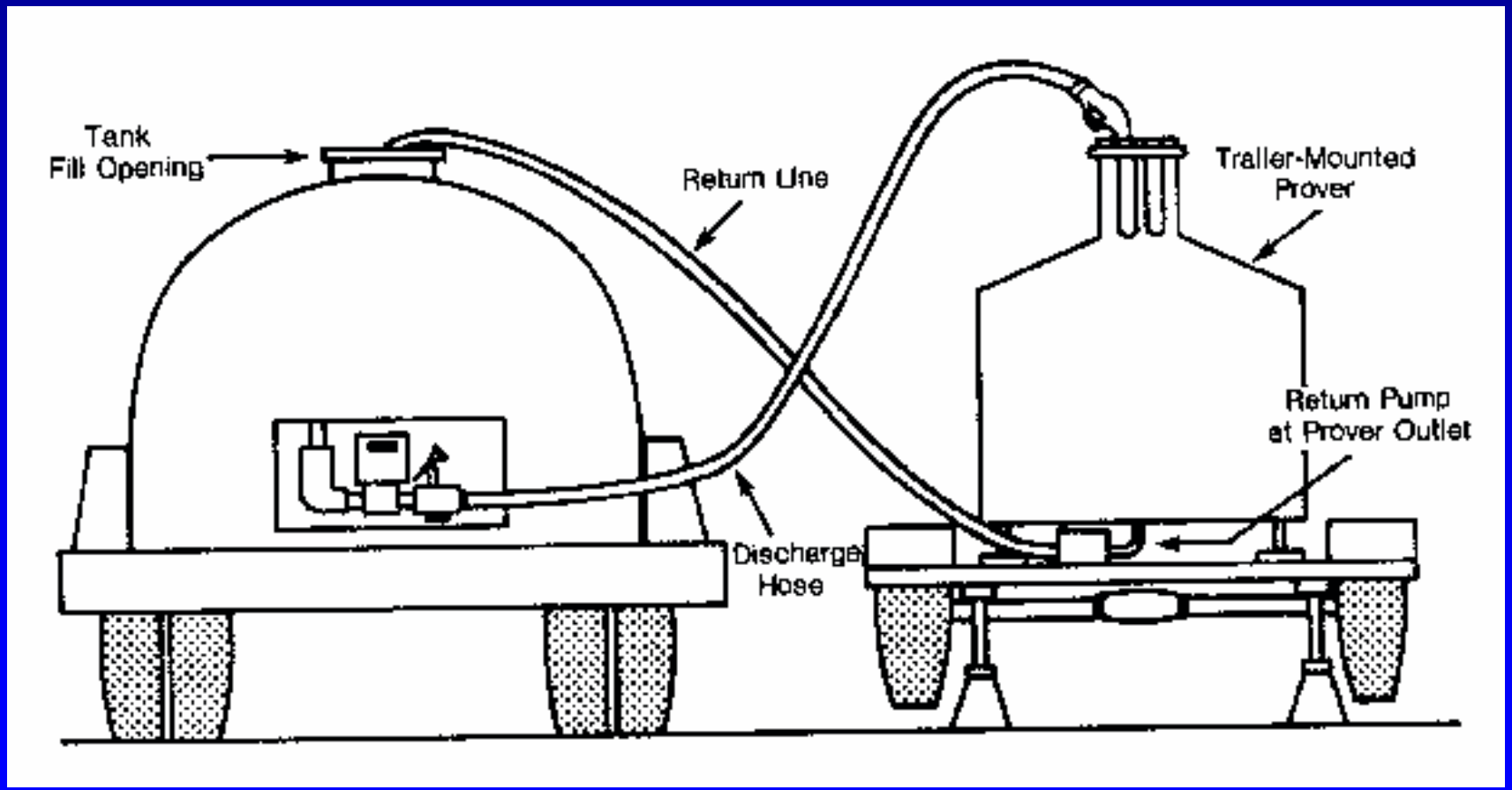
- upper gauge indicates quantities above and below nominal capacity
- wet-bottom provers also equipped with lower gauge for zeroing prover at start
- gauges secured with security seals



# Field Standard Prover

- most trailer-mounted
- grounding means
- leveling means and indicators
  - raise prover so trailer wheels are off ground
- some equipped with vapor recovery
- anti-swirl device to reduce air in product
- thermometer wells for monitoring product temperature

# Figure 4-4: Typical Prover Connection for Power-Operated Systems



# Setting Up the Prover--

- Remember: Safety First!!!

- position the prover:
  - away from source of ignition
  - near power source
    - » connect and verify pump operation before pumping product
  - location should enable you to see meter, register, & prover indications as you operate the prover valves
  - out of main traffic flow

- position fire extinguishers within easy reach
  Do Not Leave Them in the Prover!!

# Setting Up the Prover (cont.)

- position caution signs and safety cones
- ground the prover to a suitable ground
- check fittings for adapters required before proceeding
- inspect temperature wells for dirt and debris
  - clean & fill
- check security seals on prover
- chock prover trailer or vehicle
  - check again with product in the prover
- level prover, raising tires of trailer off ground
  - use level indicators

# Setting Up the Prover (cont.)

- require operator to stand by during test since they are most familiar with their equipment
  - if inspector operates or makes connections themselves, they may be held responsible for any resulting damage/contamination
- “connect” inlet and return lines
- check prover valves to be sure they are open/closed as appropriate
- verify correct tank compartment valve is open
- note and record totalizer

# Wetting the Prover

- VTM provers are CALIBRATED TO DELIVER
  - contain slightly more than their rated capacity when full
- have clingage on sides
  - impractical to remove clingage between test drafts
- wet prover at start of testing
  - wetting process is not repeated between tests unless prover sits for extended period between tests

# Wetting the Prover

1) With prover return line closed, have operator activate and engage the system pump

2) Open the VTM's delivery hose at prover inlet

3) Deliver product until product level in prover reaches nominal capacity line on prover gauge
   - watch gauge carefully when nearing quantity to avoid overflow

# Wetting the Prover (cont.)

5) Have the operator disengage the system pump

6) With prover full of liquid:
- check level of prover
- raise bed so vehicle wheels are not resting on ground
- check chocks on trailer or prover to prevent shifting

7) Verify prover return line is secure

8) Start prover return pump and return product

# Wetting the Prover (cont.)

9) Monitor sight gauge in prover return line

10) When product flow is no longer a continuous stream, start stopwatch

11) After 30-second drain, close prover return valve and turn off prover pump
  - 30-second drain period duplicates drain process during prover calibration

# Running a Test Draft

- process is similar to wetting the prover except...
- monitor flow rate closely
  - start timing at 10 gallons
  - make sure you are operating within rated minimum and maximum flow rates of device
- when liquid appears in upper neck gauge of prover:
  - try to stop *meter register* on whole increment
  - convenient (but not necessary) to stop meter indication at quantity equal to prover capacity
- before returning product, read prover to determine meter error

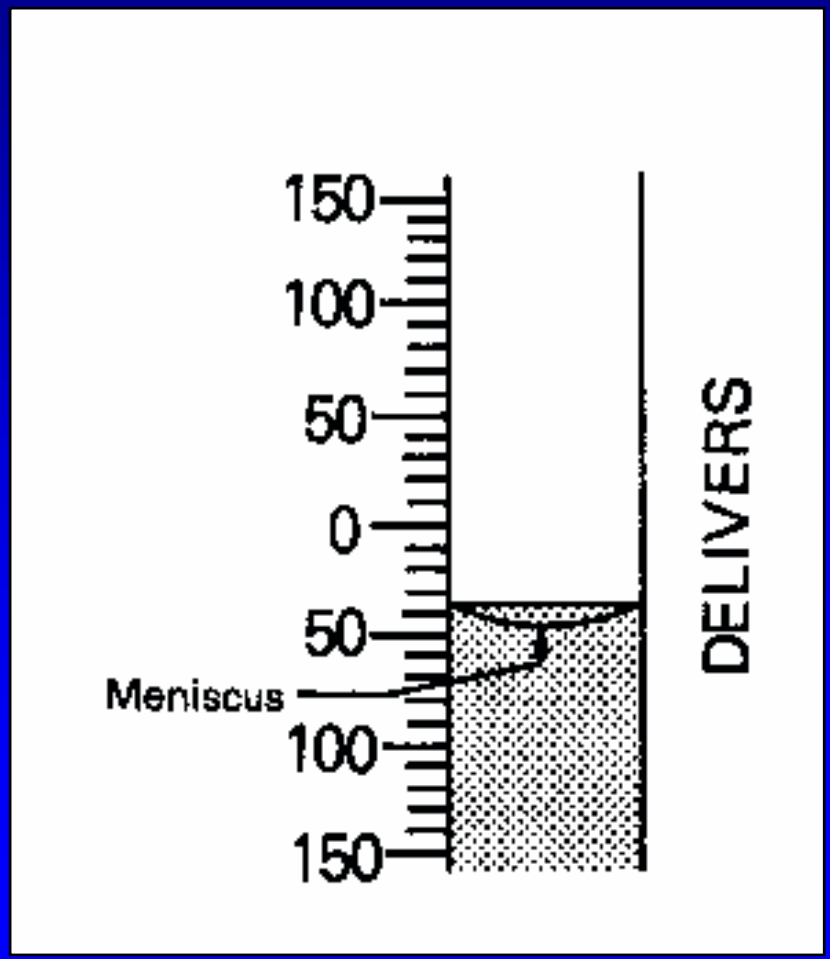
# Reading the Prover

- upper gauge plate indicates quantities above and below nominal capacity
  - when liquid is at “zero” mark, prover will deliver its nominal capacity
  - graduations indicate quantities above and below nominal capacity
  - errors above zero mark read as “plus” errors
  - errors below zero mark read as “minus” errors

# Reading the Prover

- if product foams, allow to settle before reading
- position yourself so that top of liquid is at eye level
- capillary action of glass tube creates “meniscus”
  - concave surface of liquid
  - read prover at bottom of meniscus

# Figure 4-8:
# Reading the Prover Gauge



# Prover Maintenance -- General

- note & report immediately to your supervisor:
  - any damage which has occurred to prover
  - abnormal performance, especially leaks
- repairs to be made only by qualified personnel
- have prover recalibrated if necessary following repairs
  - should have a regular reinspection/recalibration program for your prover

# Prover Maintenance…(cont.)

- cover thermometer well
  - NEVER leave thermometer in well while transporting prover
- clean & store thermometers carefully
- check & clean strainer in liquid return line regularly
- follow mfg's instructions for lubricating pump, return valves

# Summary - VTM Test Equipment

I) Basic Equipment

II) VTM Field Standard Prover

- precision test instrument

III) Reading the Prover Gauge

- read bottom of meniscus

IV) Setting Up the Prover

- includes wetting, leveling, zeroing prover

# Summary - VTM Test Equipment

V) Wetting the Prover

- calibrated to deliver

VII) Running Test Drafts

VII) Prover Maintenance

- report any damage immediately
- regular recalibration
- steps following use